HANSER

Gastrow Injection Molds

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130 Proven Designs

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Example 2, Two-Cavity Injection Mold for Elbow Connector Made from PA 66

The article consists of two half-shells (Fig. 1) that are fitted and bonded together outside the mold. Average wall thickness is approx. 2.5mm. Process shrinkage was calculated at 1% of cavity-dimensional layout. In order to fasten cable clamps for strain relief, suitably shaped universal slots are provided. Surface quality is that of technical polishing.

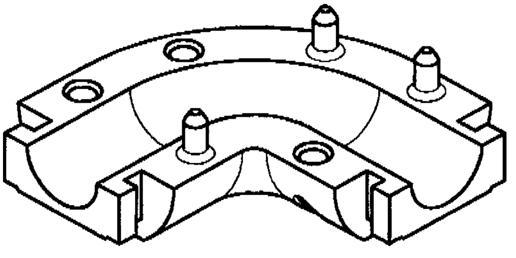


Figure 1 Half-shell of an elbow connector, diagram

Mold

The design corresponds to a standard DIN ISO 12165:2002-06 mold with a *single* parting line, Fig. 2. Changeable two-piece mold inserts (4a, b) and (5a, b) made from 1.2767 throughhardened steel are screwed to both cavity plates made from prehardened steel. The outer contour of the half-shells is shaped in mold inserts on the fixed side (4a, b), the inner contour in those on the moveable side (5a, b). Mold dimensions are $156 \times 156 \times 257$mm. The relatively large installation height results, for one, from the dimensions of the two-stage ejector. The clamping plates (1) and (10) are equipped with thermal insulation sheets (6) in order to improve thermal efficiency of the mold. The ejector assemblies (7a, b) and (8a, b) are moved by a centrally mounted, standardized two-stage ejector (11). The ejector rod (12) engages the ejector system via an automatic ejector coupling. The ejector assemblies are guided by four pillars Ball cages are used for the ejector assemblies (7a, b).

Gating

The externally heated sprue bush with tip (14) is equipped with a screwed-on screwed on gate bush (Fig. 3). A spacer ring (16) serves to attach the gate nozzle to the centering flange (15). Via a short sprue carrot and a sub runner, which is also incorporated parabolically into the gate bush, the cavities are each filled via submarine gates (see also detail BB). The gating nozzle is secured against twisting by a dowel pin (17). The three holes on each half-shell are formed by core pins (18). To form the pegs, contoured ejector sleeves (19) with core pins (20) are used (detail D). The insert (21) recognizable on the moveable side is used as a core retainer plate for another variant of the molded part (not illustrated). To eliminate the possibility of a cold slug being injected through the gate into the cavity when filling begins, there is a catch-hole in the subrunner.

Demolding

Spring-loaded ejector pins (22) pre-loaded by return pins (23) during mold closing assist demolding on the fixed side (section B-B and detail E). Due to the undercut in the ejector (24), the gating system remains at first on the moveable side. When the mold opens, the frozen sprue is pulled from the nozzle and the gate is sheared off. The ejector assemblies perform two strokes per cycle according to the sequence: stroke 1 of the two-stage ejector causes the sprue to demold, and stroke 2 enables the molded part to demold.

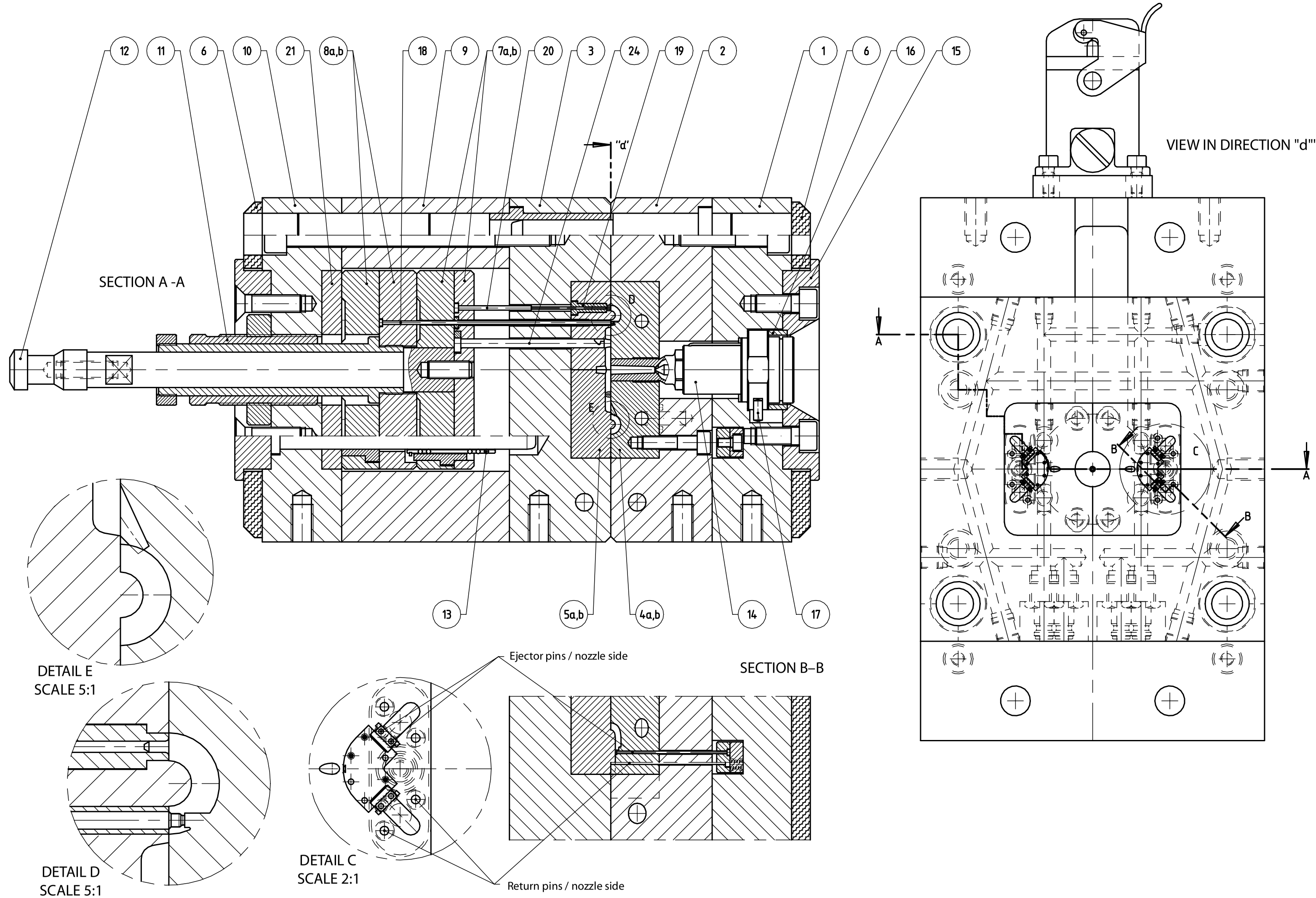


Figure 2 Two-cavity injection mold for elbow connector
1: clamping plate FS, 2: cavity plate FS, 3: cavity plate BS, 4a, b: mold inserts FS, 5a, b: mold inserts BS, 6: thermal insulation sheet, 7a, b: front ejector assembly, 8a, b: rear ejector assembly, 9: spacer strip, 10: clamping plate BS, 11: two-stage ejector, 12: ejector rod, 13: ball-bearing traveler, 14: gating nozzle with antechamber, 15: centering flange, 16: spacer ring, 17: dowel pin, 18: core pin (drills hole), 19: ejector sleeve, 20: core pin (forms peg), 21: insert, 22: spring-loaded ejector pin FS, 23: return pin FS, 24: ejector with undercut
(Courtesy: Hasco, Lüdenscheid; Möller, Bad Ems)

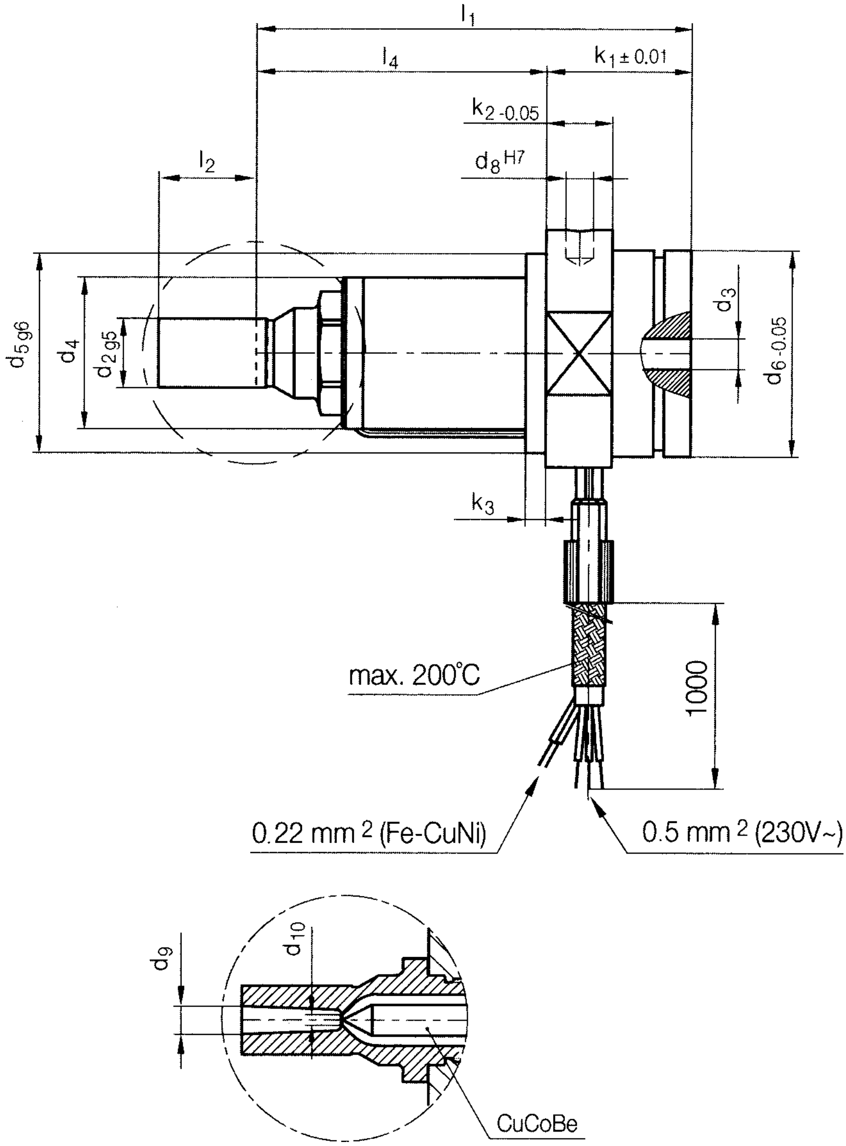


Figure 3 Heated sprue nozzle with antechamber and tip

Example 3, Injection Mold for the Body of a Tape-Cassette Holder Made from High-Impact Polystyrene

Molded Part: Design and Function

A cubic molded part of impact-resistant polystyrene (Fig. 1) forms the main body of a tape-cassette holder (Fig. 2) consisting of a number of injection-

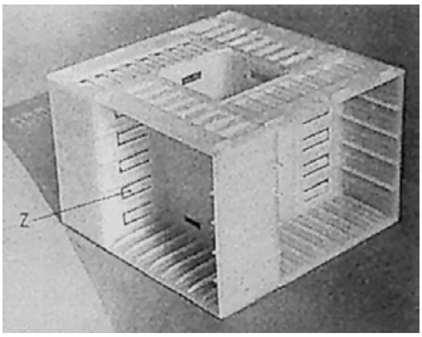


Figure 1 Main body for a cassette holder, Z: Spring latch

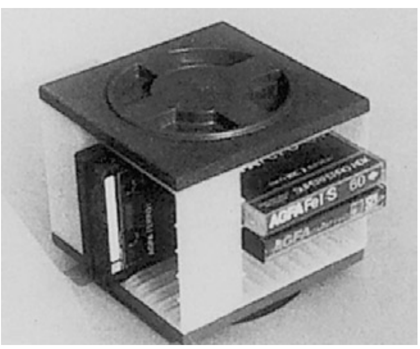


Figure 2 Finished, assembled cassette holder with the main body from Fig. 1 and several cassettes inserted

molded parts. Several cassette holders can be stacked on top of each other by snap fits to yield a tower that can accommodate more cassettes. The molded part, which has a base measuring 162 mm × 162 mm and is 110 mm tall, consists of a central square-section rod whose two ends are bounded by two square plates. Between these plates, and parallel to the central rod, are the walls, forming four bays for holding the cassettes.

Single-Cavity Mold with Four Splits

The mold, with mold fixing dimensions of 525 mm × 530 mm and 500 mm mold height, is designed as a single-cavity mold with four splits (Fig. 3). The movable splits (9) are mounted on the ejector side of the mold with guide plates (21) and on guide bars (20). The splits form the external side

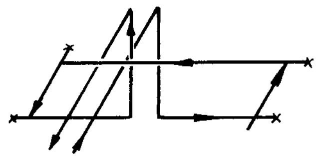


Figure 4 Cooling of the punch (7)

walls of the molded part while the internal contours of the bay's comprising ribs, spring latches and apertures are made by punches (34) that are fitted into the splits and bolted to them. Core (6), which is mounted along with punch (7) on platen (23), forms the bore for the square-section rod. The punch (7) and the runner plate (14) form the top and bottom sides of the molded part.
When the mold is closed, the four splits are supported by the punch (7) and each other via clamping surfaces that are inclined at less than 45°. Furthermore, the apertures in the molded part ensure good support between punches (34) on the splits, core (6) and runner plate (14).
The closed splits brace themselves outwardly against four wedge plates (12) which are mounted on the insert plate (18) with the aid of wear plates (13). Adjusting plates (11) ensure accurate fitting of the splits. Each slide is driven by two angle pins (8), located in insert plate (18) on the feed side. Pillars (39) and bushings (37) serve to guide the mold halves. The plates of each mold half are fixed to each other with locating pins (27).
The molded part is released from the core by ejector pins (25), which are mounted in the ejector plates (3, 4). Plate (23) is supported on the ejector side against the clamping plate via two rails (40) and, in the region of the ejector plates beneath the cavity, by rolls (2).

Feeding via Runners

The molding compound reaches the feed points in the corners of the square-section rod via sprue bushing (16) and four runners. The rod's corners

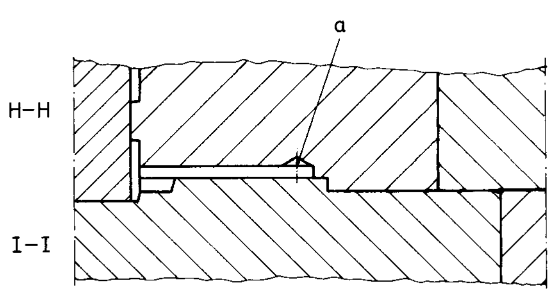


Figure 5 Detail of latch Z in the main body along H-H and I-I in Fig. 3

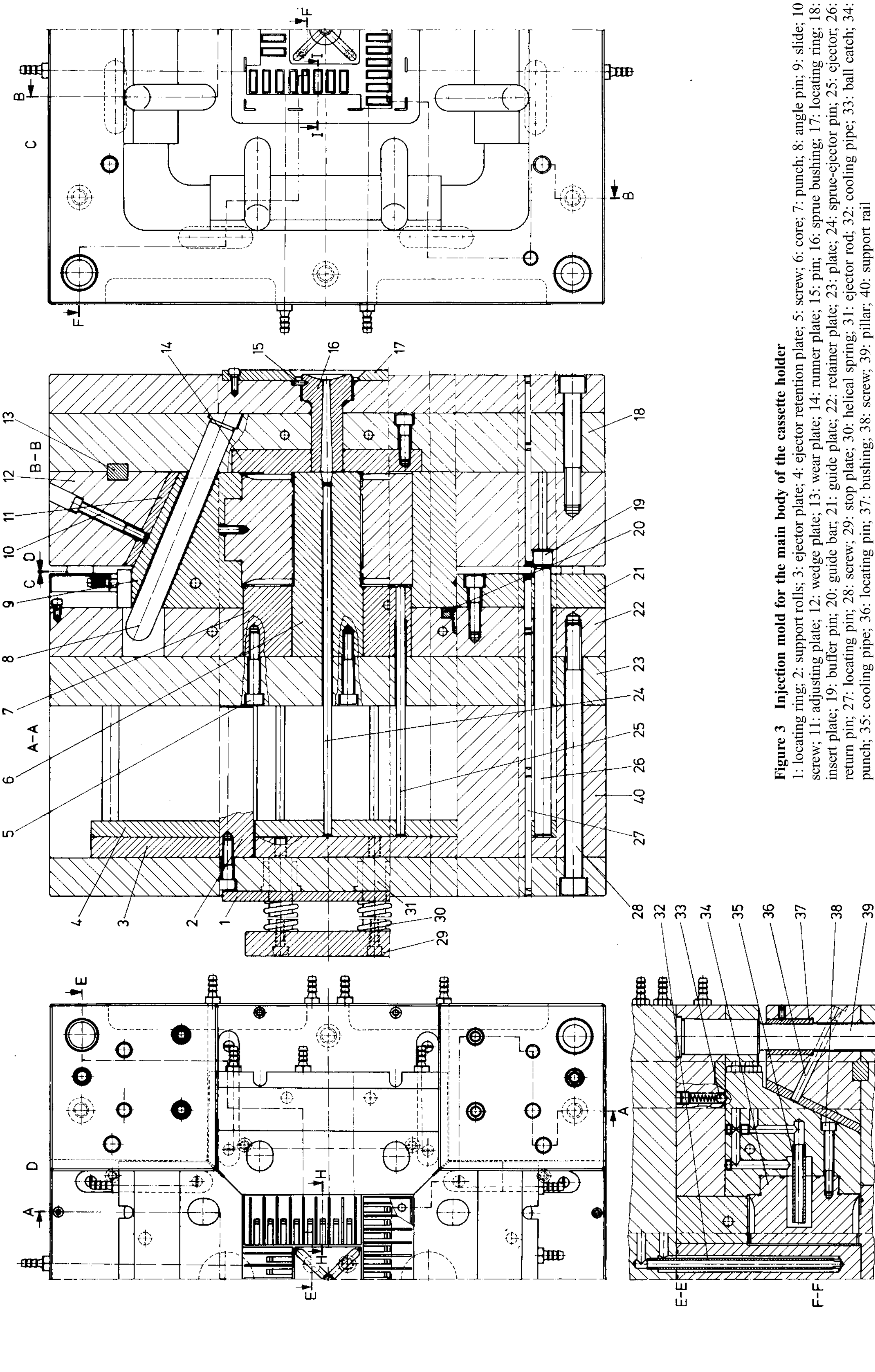


Figure 3 Injection mold for the main body of the cassette holder
1: locating ring; 2: support rolls; 3: ejector plate; 4: ejector retention plate; 5: screw; 6: core; 7: punch; 8: angle pin; 9: slide; 10 screw; 11: adjusting plate; 12: wedge plate; 13: wear plate; 14: runner plate; 15: pin; 16: sprue bushing; 17: locating ring; 18: insert plate; 19: buffer pin; 20: guide bar; 21: guide plate; 22: retainer plate; 23: plate; 24: sprue-ejector pin; 25: ejector; 26: return pin; 27: locating pin; 28: screw; 29: stop plate; 30: helical spring; 31: ejector rod; 32: cooling pipe; 33: ball catch; 34: punch; 35: cooling pipe; 36: locating pin; 37: bushing; 38: screw; 39: pillar; 40: support rail
Company illustration: Plastor p.A., Oradea/Romania

have a slightly larger flow channel than the other walls of the molded part. The sprue bushing is secured against turning by pin (15).

Mold Temperature Control

Cooling channels are located in the core retainer plate (22) and the insert plate (18). Punch (7) is cooled as shown in Fig. 4. Core (6) is fitted with two cooling pipes, while punch (34) is fitted with cooling pipe (35). Furthermore, the slide (9) are cooled.

Demolding

As the mold opens, the slides (9) are moved by the angle pins (8) to the outside until the punches (34) are retracted from the side bays of the molded part. As Fig. 5 shows, the cavities of the spring latches Z are located on the one hand between the faces of the four punches (34) and runner plate (14) and, on the other, between the two adjacent side faces of the punches (34).

On opening of the mold, the ratio of the distance moved by the slides to the opening stroke between runner plate (14) and slides is the tangent of the angle formed by the angle pins and the longitudinal axis of the mold. Thus, when the mold opens, enough space is created behind the latches Z to enable them to spring back when the punches (34) slide over the wedge-shaped elevations (a) of the latches (Fig. 5). The situation is similar for ejecting latches between adjacent punch faces. As the mold opens further, the angle pins and the guide bores in the slides can no longer come into play. The open position of the slides is secured by the ball catches (33). The molded part remains on core (6) until stop plate (29) comes into contact with the ejector stop of the machine and displaces ejector plates (3, 4) with ejector pins (24, 25). The molded part is ejected from the core, and the sprue from the runners. When the stop plates are actuated, helical springs are compressed (30) that, as the mold is closing, retract the ejector pins before the slides close. Return pins (26) and buffer pins (19) ensure that the ejector system is pushed back when the mold closes completely.

Example 4, Five-Cavity Injection Mold for Tablet Tubes Made from Polystyrene

It has been found that especially with tubes which are relatively long in relation to their diameter, it is extremely difficult to prevent displacement of the core and avoid the resulting variation of wall thickness with all the detrimental consequences. As the result of uneven melt flow, the core may become displaced toward one side even when a centrally positioned pinpoint gate is used on the bottom.
In the following, an injection mold is described, in which displacement of the core is reliably prevented. It has been determined that gating from two opposite points on the open end of the tube already leads to considerably less displacement of the core than occurs when gating on the bottom. It is useful to design these two points as tunnel gates so that they are automatically sheared on opening of the mold which eliminates the need for any secondary operations.
With long tubes, however, even this type of gating is not enough to ensure completely uniform wall thickness. The core must be held in position until the melt reaches the bottom.
This is accomplished in the mold shown in Figs. 1 to 4 as follows:
To avoid an unnecessarily long sprue, the water-cooled cores (*a*) are fastened on the stationary mold half. The face of the core has a conical recess about 0.5 mm deep into which a conical protrusion on the movable core (*b*) is pressed by means of spring washers (*c*) when the cavity is not filled. As soon as the plastics melt fills the cavity to the bottom and flows into the annular space around the protrusion, the injection pressure overcomes the force exerted by spring washers and displaces the movable core (*b*) by an amount corresponding to the thickness of the bottom. The entire bottom now fills with melt. A vent pin (*d*) with running fit in the movable core (*b*) to permit the compressed air to escape is provided to ensure that the melt will flow together properly at the center of the bottom.
As the mold opens, the spring washers assist in ejecting the tablet tubes from the cavities as well as in shearing off the two tunnel gates. The tubes are supposed to be retained on the cores, from which they are stripped by the stripper plate (*e*) during the final portion of the opening stroke. The runner system is initially retained by undercuts on the sucker pins (*f*). However, as soon as the stripper plate (*e*) is actuated, the runner system is pulled off the sucker pins (*f*) and drops out of the mold separated from the molded parts.

Example 4

Fig. 1

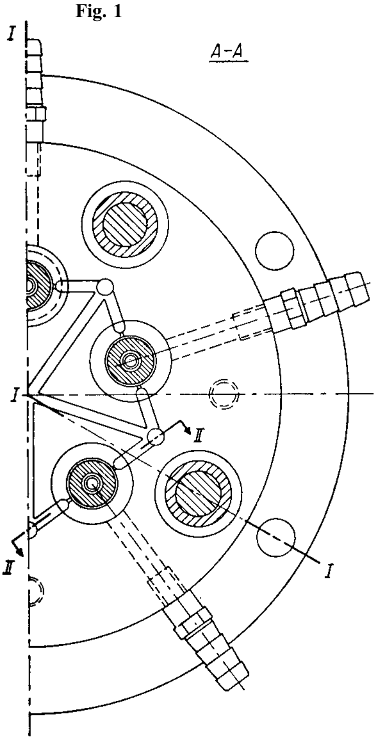


Fig. 2

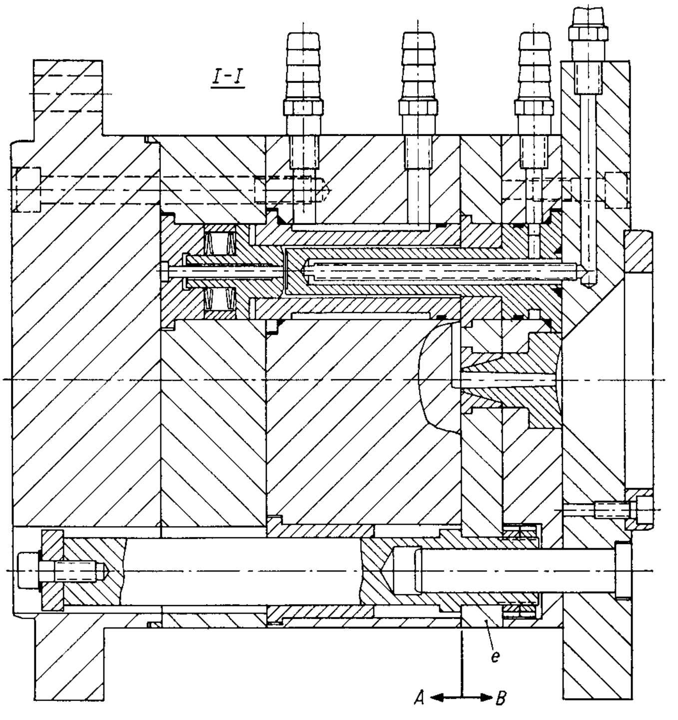


Fig. 3

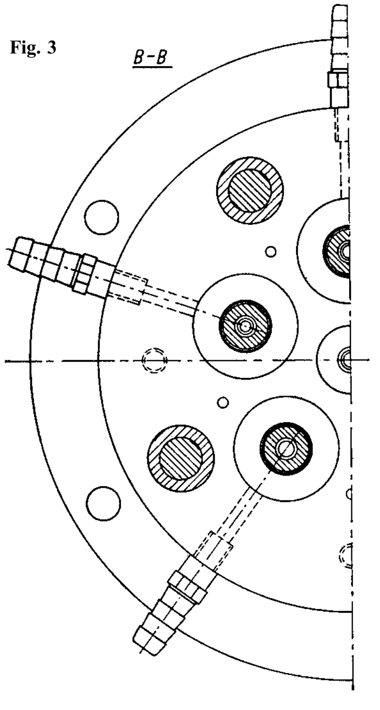
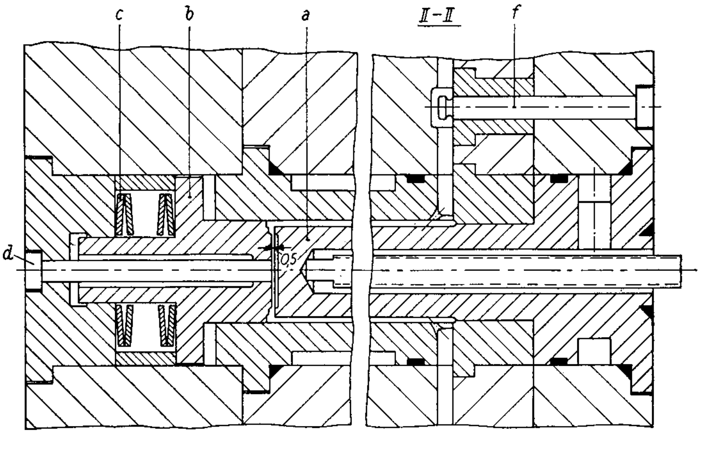


Fig. 4



Figures 1 to 4 Five-cavity mold for long tablet tubes
a: water-cooled core; *b*: movable core; *c*: spring washers; *d*: vent pin; *e*: stripper plate; *f*: sucker pin

Example 5, Four-Cavity Injection Mold for a Polyamide Joint Element

The element (Fig. 1) is similar to a pipe fitting. It has four socket openings, two of which form a through-hole. The other two openings are located in the plane perpendicular to this hole such that their axes enclose an angle of 84°. The 84° branch contains a rib with a hole.

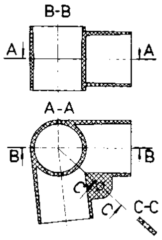


Figure 1 84° joint element

Mold

The mold with a size of 560 cm × 560 cm × 345 cm high (Figs. 2–13) is designed with four cavities such that the cavities enclosing the 84° angle lie within the parting plane, whereas the through-hole extends in the opening direction of the mold.

The four mold cavities formed in the mold insert plates (12, 13) are arranged in the parting plane in such a way that each of two mutually parallel cores of a pair of cavities can be actuated by a common core puller. Six slide bars are thus available for pulling the eight cores.

The core slide bars (24, 28) run on the mold plate (6) in guides (35, 38) and on slide rails (32, 36). The closed slide bars are locked by locking wedges (21, 30). Angular columns (22, 29), which are fixed to

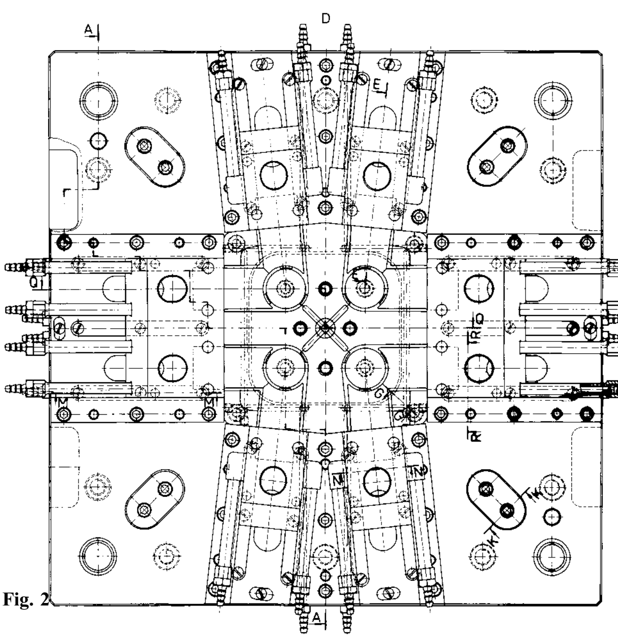


Fig. 2

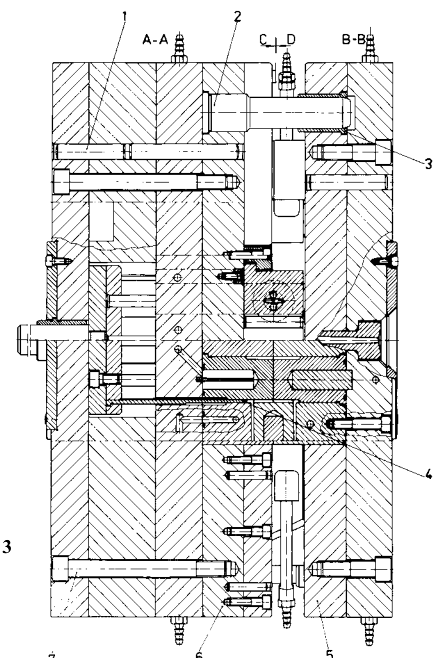
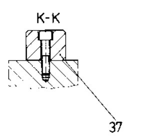
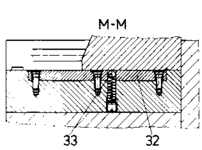
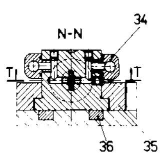
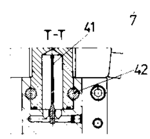


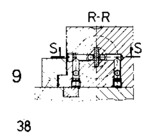
Fig. 3











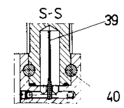


Fig. 4 Fig. 5 Fig. 6 Fig. 7 Fig. 8 Fig. 9

Figure 2 View of the movable parting plate of the mold at the ejector side (cf. Fig. 3, view D)

Figure 3 Longitudinal section A-A (cf. Fig. 2) and B-B (cf. Fig. 10)
1: locating pin; 2: guide column; 3: guide bush; 4: cavity ejector; 5: fixed mold plate; 6: movable mold plate

Figure 4 Section K-K (cf. Fig. 3)
37: check buffer

Figure 5 Section M-M (cf. Fig. 3)
32: slide rail; 33: ball detent

Figure 6 Section N-N through the individual slide bar (cf. Fig. 2)
34: cooling water connector; 35: slide-bar guide; 36: side rail

Figure 7 Section T-T through the slide core (cf. Fig. 6)
41: partition wall (for cooling water diversion); 42: cylindrical pin

Figure 8 Section R-R through the double slide bar (cf. Fig. 2)
38: slide bar guide

Figure 9 Section S-S through the slide-bar core (cf. Fig. 8)
39: partition wall; 40: cylindrical pin

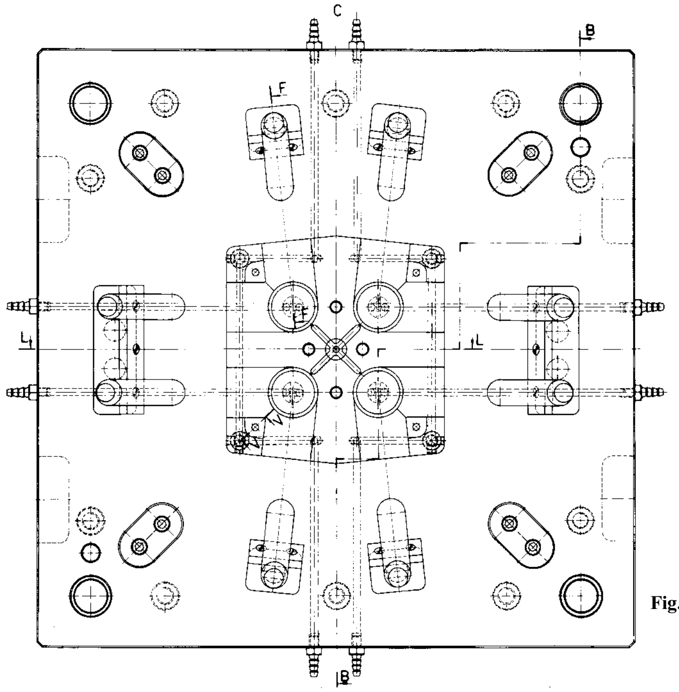


Fig. 10

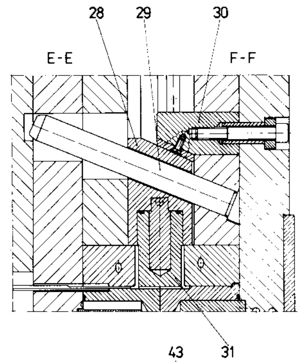


Fig. 11

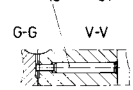


Fig. 12

Figure 10 View of the feed-side (fixed) parting plane (cf. Fig. 3, view C)

Figure 11 Longitudinal section E-E (cf. Fig. 2) and F-F (cf. Fig. 10)
28: individual slide bar; 29: angular column; 30: locking wedge; 31: core insert

Figure 12 Sections G-G (cf. Fig. 2) and V-V (cf. Fig. 10) through the pin for the "string hole"
43: pin

the mold plate (5) at the feed side, engage in the slide bars and actuate them as the mold is opened and closed. Ball detents (33) secure the position of the opened slide bars when the angular columns are moved out of the slide bars. The core inserts (18, 31) are fixed in the slide bars by means of cylindrical pins (40, 42).

Because of the large number of slide bars, the clamping area of the mold is comparatively large compared with the closing area between the mold insert plates (12, 13), which is determined by the mold cavities. To ensure uniform loading of the parting plane during closing, check buffers (37) are mounted on both mold plates (5, 6).

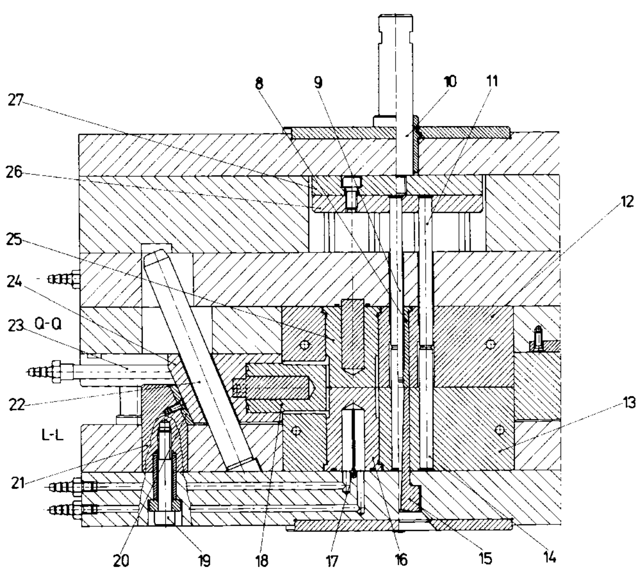


Figure 13 Longitudinal sections L-L (cf. Fig. 10) and Q-Q (cf. Fig. 2)
8: sprue puller bush; 9: sprue ejector; 10: ejector bolt; 11: ejector-plate return pin; 12, 13: mold insert plates; 14: buffer pin; 15: sprue bush; 16: core insert; 17: partition wall; 18: core insert; 19: screw; 20: locating strip; 21: locking wedge; 22: angular column; 23: connection tube; 24: double slide bar; 25: core insert; 26, 27: ejector plates

Gating

The melt is fed, via conical sprue in the sprue bushing (15) and via cruciform runners located in the parting plane, to the pinhole gates at the side walls of the four cavities.

Cooling

To cool the cavities, cooling bores are incorporated into the mold insert plates (12, 13). All four cores of each mold cavity are efficiently cooled by means of a central bore containing an inserted partition wall (17, 39, 41). The seat surfaces of the core inserts are sealed by O-rings. The cores inserted into the slide bars are supplied with water via connection pipes (23) and flexible hoses. The water for the fixed cores is fed and discharged via bores in the respective mold plates lying below the cores.

Demolding

When the mold opens in the parting plane C-D (Fig. 3), the moldings remain on the ejector side, where they are first held by the core slide bars. This pulls the moldings off the cores (16) at the feed side and out of the cavity parts. The sprue cone is demolded by the sprue puller.
During the opening action, the slide bars are pushed outward by the effect of the angular columns and pull the cores located in the parting plane. During this process, the moldings are still held firmly by the cores (25) at the ejector side. Finally, cavity ejectors (4) (three per mold cavity) and the sprue ejector (9) eject the molding completely.
As the mold closes, ejector-plate return pins (11), which strike against buffer pins (14), push back the ejector plates, and thus the cavity ejectors and sprue ejector. The core pullers are brought back into the ejection position by the angular columns. The mold is operated semi-automatically.
The prime objective in describing this injection mold was to demonstrate the arrangement and operation of the core pullers. To save sprue material, it would of course be possible to use a hot-runner nozzle instead of the conical sprue bush. It would then be possible to separate the moldings from the cruciform sprue automatically by means of submarine gates.

Example 6, Mold Base with Replaceable Inserts to Produce Standard Test Specimens

Component testing, product development and short production runs often require injection molded parts that have been produced under defined and reproducible conditions. Conventional molds have long mold change times, with the disadvantages of lengthly idle times and excessive residence time of the melt in the barrel. Purging of the melt would mean a material loss that could not be justified with the often small quantities of expensive experimental materials.
In order to avoid these disadvantages, a mold base was developed that meets all of the requirements with regard to processing, economy and reliability of operation. This mold base with interchangeable plug-in inserts is also suitable for production of flat molded parts, e.g. gears, small plaques etc., and is characterized by the following features.
The mold cavity is located in the interchangeable mold plate (1) on the ejector side (plug-in insert). The cavity is machined only into this plate, which seals against a flat mating plate (2) bolted to the stationary-side clamping plate. The plug-in inserts can be removed and stored without any aids within approximately one minute. The weight of each plug-in insert is approx. 6 kg.

Mold Temperature Control

The cooling lines for mold temperature control are located in the plug-in insert and mating plate. Self-closing quick disconnects (3) in the supply lines facilitate replacement of the inserts. With a suitably sized mold temperature control unit, the insert reaches operating temperature after only 8 shots thanks to optimum positioning of the cooling lines.

Cavity Pressure and Cavity Wall Temperature

Cavity pressure and cavity wall temperature are measured and recorded along with additional important process variables. Only similar test specimens are produced in a given insert. The mold design permits simultaneous filling of all cavities and is based largely on the use of commercially available standard mold components. The materials used, heat treatment (core 64 RC) and surface treatment (CVD for the mating plate, surface 72 RC) ensure high wear and corrosion resistance.

Fig. 1

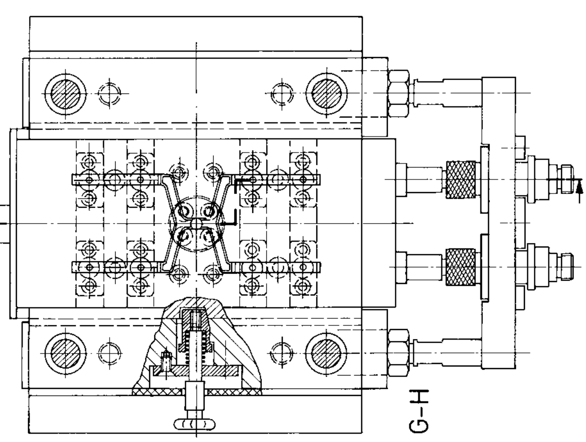


Fig. 2

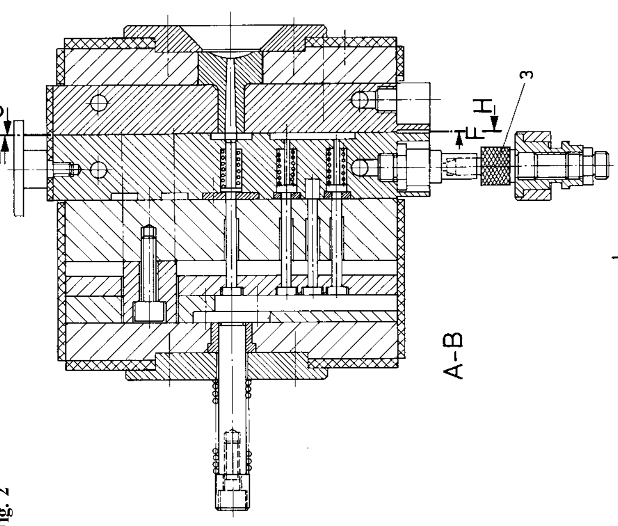


Fig. 3

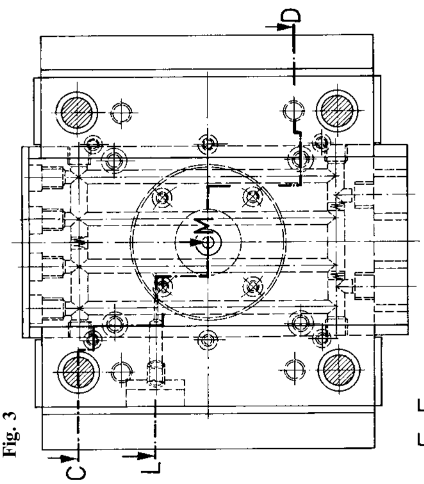


Fig. 4

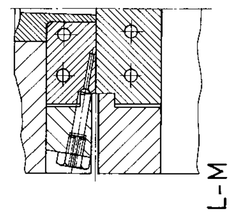


Fig. 5

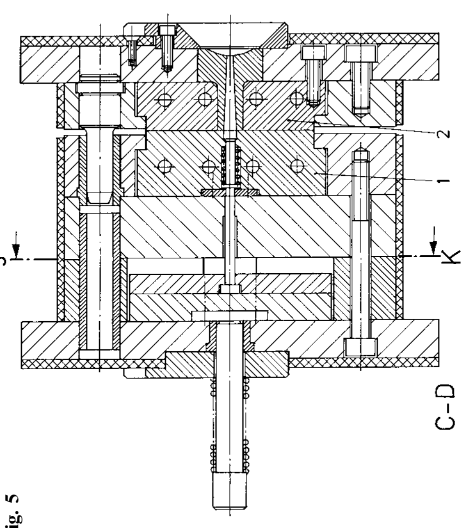
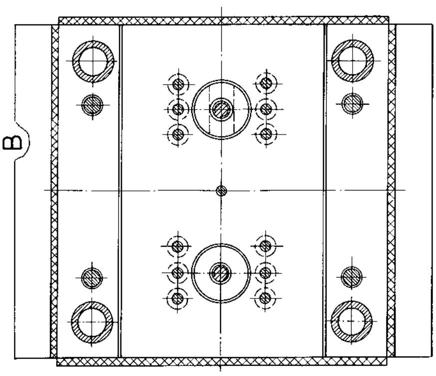


Fig. 4



Figures 1 to 6 Mold base with interchangeable inserts for the production of standard test specimens
1: plug-in insert; 2: mating plate; 3: quick disconnect